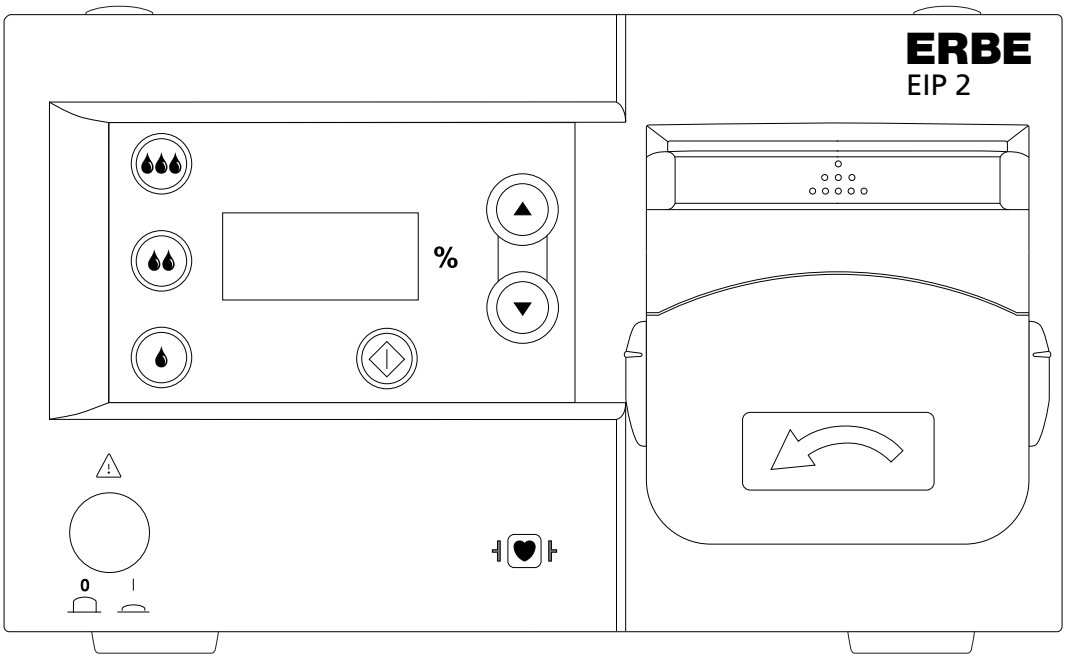
Service Manual

EIP 2

V 1.0.x
V 1.1.x



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ERBE

Service Manual

EIP 2

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Service Manual Art.-No. 80116-261

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CHAPTER 1

Safety information

Classification of the safety information

WARNING! The WARNING! safety indication refers to a risk of personal injury.

CAUTION! The CAUTION! safety indication refers to a risk of damage to property.

ATTENTION! The ATTENTION! safety indication refers to a risk which can cause equipment to become unserviceable.

IMPORTANT! The IMPORTANT! designation indicates application information and other particularly important information.

Knowledge of the User Manual

The User Manual for this unit constitutes an integral part of this Service Manual. For performing servicing activities it is assumed that the reader has knowledge of the User Manual, especially procedures for installation, putting into operation, and handling.

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Protection from the risk of electric shock

WARNING! The supply voltage must match the voltage specified on the rating plate. Connect the unit / the equipment cart to a properly installed grounded outlet. Only use the ERBE power cord or an equivalent power cord for this purpose. The power cord must bear the national test symbol.

For safety reasons, multiple outlets and extension cords should not be used. If their use is unavoidable, they also must be provided with proper grounding.

WARNING! Unplug the power cord from the outlet before exchanging parts of the unit or cleaning it.

WARNING! Do not plug a wet power cord into the unit or into an outlet.

WARNING! Do not touch any unprotected wires or conductive surfaces while the unit is opened and under voltage.

WARNING! Blown line fuses may only be replaced by a competent technician. Only replacement fuses of the rating specified on the unit's name plate may be used. Before resuming operation the unit must be subjected to a performance test by a competent technician.

Electrostatically sensitive components

CAUTION! This unit contains electrostatically sensitive components. Work at an anti-static workplace while repairing the unit. Wear a grounding armband while working with electrostatically sensitive components. Hold the circuit boards by their non-conducting corners. Use an anti-static container for transporting electrostatically sensitive components and the circuit boards.

Liability and warranty

ATTENTION! Adjustments, tests, modifications, maintenance and repair work may only be performed by ERBE or persons trained by ERBE. If the work is not performed by trained persons, ERBE accepts no liability and warranty rights become void.

It is recommended that the technical safety check also be performed by ERBE or persons trained by ERBE.

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ATTENTION! Only use original ERBE spare parts. The manufacturer accepts no liability and the warranty rights becomes void if original spare parts are not used.

CHAPTER 2

Modifications

From V 1.1.x

Hardware

No changes

Software

Component affected	Description of the modification
Service programs	New Service program: S 5 Automatic pressure control

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CHAPTER 3

Unit description

Unit variants

The EIP 2 (ERBE Irrigation Pump) is available in the following unit variants:

- **230 V** with ECB socket[1]
- **230 V** without ECB socket
- **120 V** without ECB socket
- **100 V** with ECB socket
- **100 V** without ECB socket

Factory setting

The EIP 2 has the following settings when it is delivered by the manufacturer:

- Quick activation button I = 30%[2]
- Quick activation button II = 50%
- Quick activation button III = 80%
- Automatic pressure control activated
  for units up to software version 1.0.0
- Automatic pressure control deactivated
  (for units from software version 1.1.0)

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IMPORTANT! Once settings have been changed and saved they still apply even after the unit has been restarted. A reset (= switching the unit back to the factory setting) is not possible.

1. ECB = ERBE Communication Bus for connecting the EIP 2 to a VIO electrosurgical unit.
2. Flow in % relative to the maximum flow of 500 ml/min.

Controls

IMPORTANT! This chapter contains an overview of the controls of the unit(s). The relevant User Manual for the unit(s), knowledge of which is assumed for servicing work, provides detailed information about how to use the unit(s).

Controls at the front

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Fig. 3-1

1 Power switch

2 Quick activation button I (30 % of capacity[1] / approx. 150 ml/min)

3 Quick activation button II (50 % of capacity / approx. 250 ml/min)

4 Quick activation button III (80 % of capacity / approx. 400 ml/min)

5 Flow display

6 Up / Down buttons

7 Activation button

8 Pump head lid

9 Direction arrow for irrigation liquid

1. Flow in % relative to the maximum flow of 500 ml/min.

Symbols

Read User Manual.

The unit meets the requirements of Type CF and is protected against the effects of a defibrillator discharge.

Never place your fingers in the pump head.

Controls at the rear

Fig. 3-2

1 Optional ECB socket (ECB = ERBE Communication Bus) for connecting the EIP 2 to a VIO electrosurgical unit

2 Footswitch socket

3 Potential equalization

4 Power connection

5 Power fuse

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Description of function

Peristaltic pump principle

The EIP 2 (ERBE Irrigation Pump) is a peristaltic pump. This operating principle is based on pressing or squeezing a flexible pump hose at one or more points and on movement of the squeezed point in the desired direction of liquid flow. For this reason peristaltic pumps are sometimes referred to as peristaltic squeeze pumps. Movement of the squeezed point is accomplished with the aid of a pump rotor that has rollers around its perimeter. Flow is determined by rotor speed (speed of motion of the squeezed point) and internal cross-section of the hose.

Advantages of peristaltic pumps

With peristaltic pumps the medium and the pump do not come into contact with one another. Therefore peristaltic pumps are particularly suited for metering a very wide range of media. As opposed to other types of pump like diaphragm pumps, with peristaltic pumps it is very easy to adapt the material of the pump hose, or components coming into contact with the medium, to the product being pumped. A pump hose is selected and used that is chemically suited for the product being pumped ("milled hose").

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CHAPTER 4

Technical Data

Power supply for devices with 230 V			
Nominal line voltage	Line current	Power fuse	Nominal line frequency
230 V ± 10%	200 mA	T 0.2 A	50 / 60 Hz
Power input in Standby Mode		5 W	
Power input at max. irrigation flow		20 W	
Potential equalization terminal		Yes	

Power supply for devices with 120 V			
Nominal line voltage	Line current	Power fuse	Nominal line frequency
120 V ± 10%	400 mA	T 0.4 A	50 / 60 Hz
Power input in Standby Mode		3 W	
Power input at max. irrigation flow		20 W	
Potential equalization terminal		Yes	

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Power supply for devices with 100 V			
Nominal line voltage	Line current	Power fuse	Nominal line frequency
100 V ± 10 %	315 mA	T 0.315 A	50 / 60 Hz
Power input in Standby Mode		3 W	
Power input at max. irrigation flow		20 W	
Potential equalization terminal		Yes	

Operating mode	
Continuous duty	Yes

Dimensions and weight	
Width x height x depth	205 x 125 x 170 mm (without pump head)
Width x height x depth	205 x 125 x 210 mm (with pump head)
Weight	3 kg

Ambient conditions for transport and storage of unit	
Temperature	-40 °C to + 70 °C
Relative humidity	10% – 95%

Ambient conditions for operation of unit	
Temperature	+10 °C to + 40 °C
Relative humidity	15% – 80%, noncondensing

Acclimatizing
If the unit has been stored or transported at temperatures below +10 °C or above +40 °C, the unit will require approx. 3 hours to acclimatize at room temperature.

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Standards	
Classification according to EC Directive 93/42/EEC	II a
Protection class as per EN 60 601-1	I
Type as per EN 60 601-1	CF

CHAPTER 5

Installation

Installation possibilities

For EIP 2 (ERBE Irrigation Pump) there are three installation possibilities:

- Installation on an ERBE VIO Cart.
- Installation on an ERBE Universal Cart.
- EIP 2 as a stand alone variant.

These installation possibilities are described in the User Manual for the EIP 2 and the User Manuals for the above equipment carts.

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CHAPTER 6

Circuit Descriptions

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Block diagram EIP 2 (120 V / 230 V)

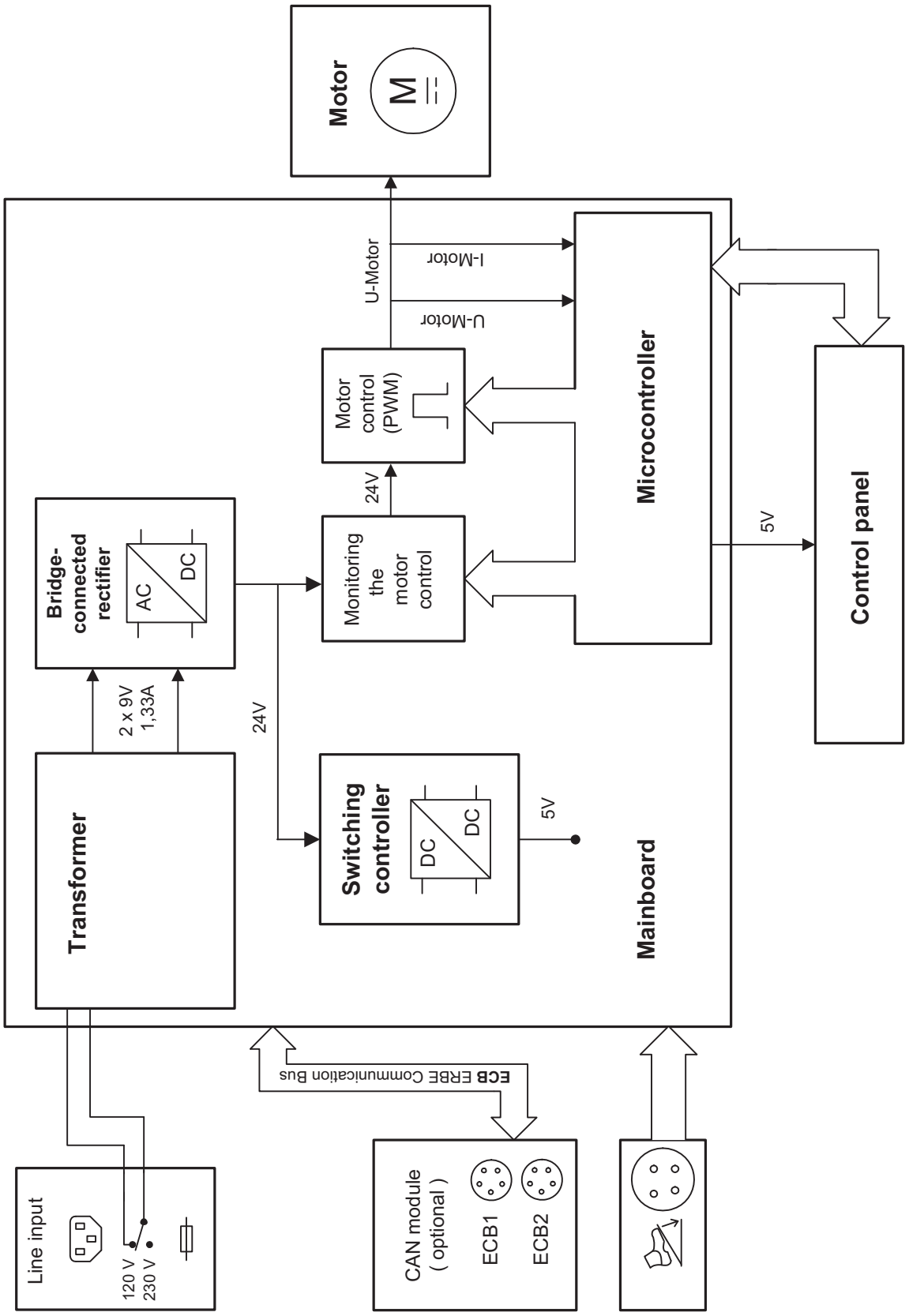

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Fig. 6-1

Block diagram EIP 2 (100 V)

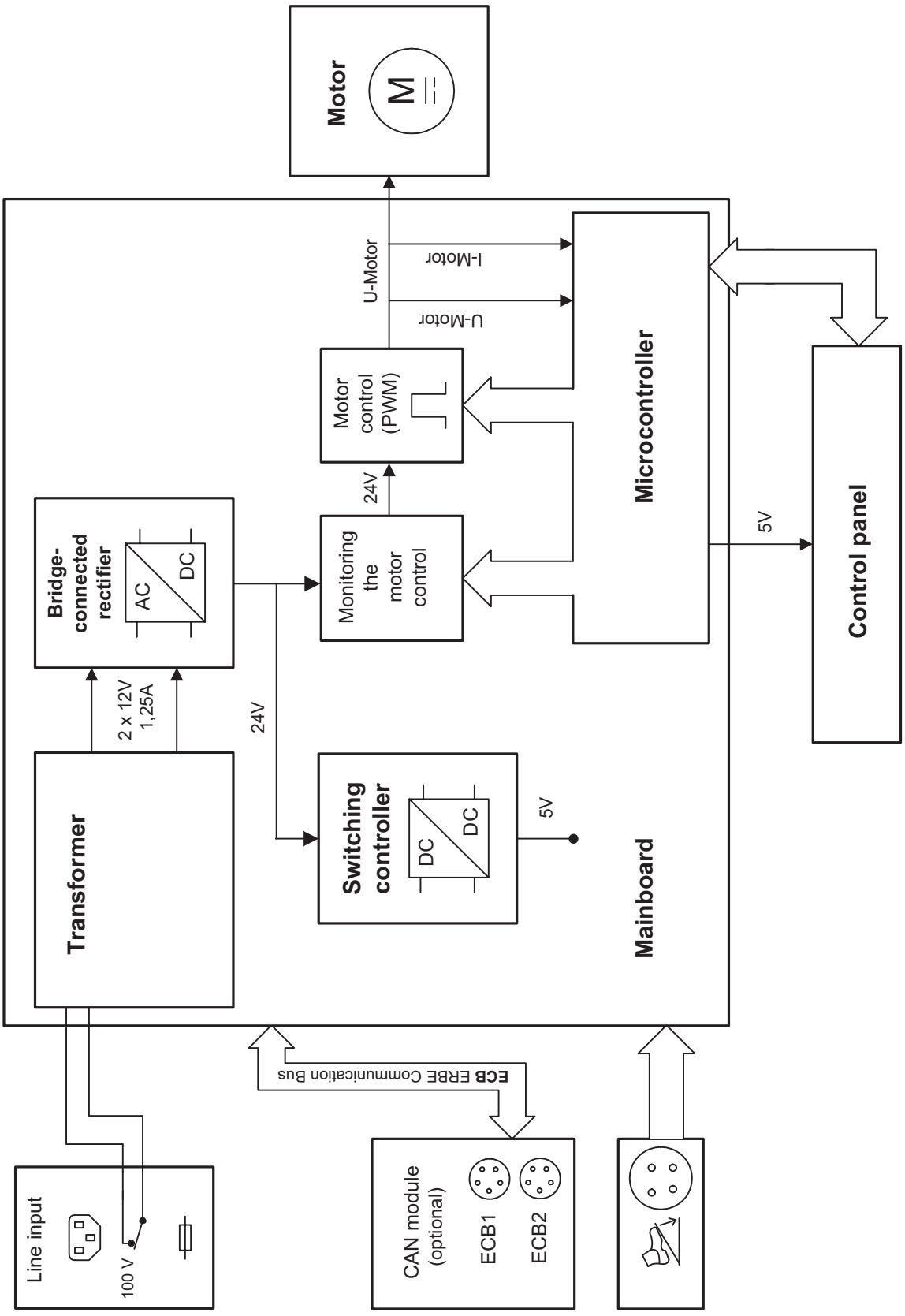

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Fig. 6-2

Description of the various assemblies

Line input

The EIP 2 can be operated on line voltages of 230 V, 120 V, or 100 V. First of all the appropriate figure must be set, ±10 %, in the window of the voltage selector switch on the main board.

CAUTION! || An incorrect setting can cause damage to the unit.

Transformer

The transformer converts the line voltage input from 230 V ±10 % or 120 V ±10 % to 2 x 9 V. The maximum available current is 1.33 A.

For operation of the EIP 2 at a line voltage of 100 V ±10 % a different type of transformer must be used. That transformer converts the line voltage input to 2 x 12 V um. The maximum available current is 1.25 A.

Bridge-connected rectifier

The bridge-connected rectifier provides the operating voltage of 24 V.

Switching controller

The switching controller provides an operating voltage of 5 V.

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Monitoring the motor control

This circuit is designed to prevent a faulty motor control from leading to uncontrolled pump activity. The operating voltage of 24 V is only supplied to the motor control if the microcontroller releases it by actuating the monitoring circuit accordingly.

Motor control

The motor control is regulated by the microcontroller via a PWM signal at a level of 5 V. The output voltage of the motor control is increased to a maximum of 24 V depending on the PWM signal.

Microcontroller

The Type PIC18F258 microcontroller handles several tasks:

- Evaluation of current and voltage measurements of motor monitoring
- Adjustment of motor control to the current and voltage levels via a PWM signal
- Checking of any activations by pushbutton or footswitch
- Updating of display on the control panel
- Communication via a CAN interface with the VIO electrosurgical unit (only on units with ECB socket, ECB = ERBE Communication Bus).

CAN module (optional)

The CAN module enables communication between EIP 2 and the VIO electrosurgical unit.

Footswitch

The pump can be activated with the EIP 2 footswitch.

Control panel

The control panel makes it possible for the user to perform settings on the EIP 2.

Three so-called quick activation buttons enable direct adjustment of the setting, which is otherwise performed using the Up and Down buttons. The pump can be started with the activation button.

The display section on the control panel is comprised of three 7-segment displays, which are updated constantly by the microcontroller.

Motor

The motor is a DC motor with a nominal voltage of 24 V and a nominal current of 1.1 A.

The motor has a flanged gear unit, via which the pump head is driven.

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CHAPTER 7

Service programs

Calling up service program mode

When switching on the unit hold down the up / down buttons.

On units with an ECB socket (ECB = ERBE Communication Bus) the service programs can be called up either by pressing the above button combination or via CAN-ID.

Navigating between service programs

As soon as the unit is in service program mode, you can toggle between the various service programs S1 – S5 using the up / down buttons.

Leaving the service program mode

Hold down the up / down buttons until the display shows .

The unit performs a program reset and starts up again in operating mode.

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Description of service programs

Service program S1 Flow test

Description

The S1 service program is used to check the flow of irrigation liquid over a period of 1 minute at a flow setting of 100 %.

If the service program ends successfully, the message "CS1" (Complete Service Program 1) is output on the display. If a fault occurs during execution, the message "ES1" (Error Service Program 1) is displayed.

Both messages can be canceled by pressing the activation button.

If a fault occurs during execution, its cause can be localized in operating mode. To do this, abort the service program. The unit then automatically switches to operating mode and the display shows an error message.

Run time

1 minute.

Set value

Fixed at 100 %.

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To activate the service program

Press the activation button.

To abort the service program

Press quick activation button III.

Service program S2 LED Test

Description

Service program S2 is used to check correct operation of all the LEDs on the control panel.

Run time

Not limited.

Set value

Not applicable.

To activate the service program

Press the activation button.

To abort the service program

Press quick activation button III.

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Service program S3 Continuous running / Burn-In

Description

Service program S3 checks whether EIP 2 can withstand a substantial continuous load.

If the service program ends successfully, the message "CS3" (Complete Service Program 3) is output on the display. If a fault occurs during execution, the message "ES3" (Error Service Program 3) appears.

Both messages can be canceled by pressing the activation button.

If a fault occurs during execution, its cause can be localized in operating mode. To do this, abort the service program. The unit then automatically switches to operating mode and the display shows an error message.

Run time

10 minutes.

Set value

Fixed at 80 %.

To activate the service program

Press the activation button.

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To abort the service program

Press quick activation button III.

Service program S4 Version output

Description

Service program S4 indicates the software version of EIP 2.

Run time

Not limited.

Set value

Not applicable.

To activate the service program

Press the activation button.

To abort the service program

Press quick activation button III.

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Service program S5 Automatic pressure control

Availability

From software version 1.1.0.

Description

The automatic pressure control of the EIP 2 can be activated and deactivated with service program S5.

Run time

Not limited.

Set value

When service program S5 is activated, a selection can be made between the following settings with the up / down buttons:

Display S50: Automatic pressure control deactivated.

Display S51: Automatic pressure control activated.

The internal EEPROM of the PIC18 automatically saves the setting selected.

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To activate the service program

Press the activation button.

To abort the service program

Press quick activation button III.

CHAPTER 8

Remedying malfunctions

WARNING! Unplug the power cord from the outlet before exchanging parts of the unit or cleaning it.

ATTENTION! Adjustments, technical tests, modifications, maintenance and repair work may only be performed by ERBE or persons trained by ERBE. If the work is not performed by trained persons, ERBE accepts no liability and warranty rights become void.

Error	Possible cause	Remedy
The set value flashes and the pump is deactivated.	Time out error. The activation time of t < 20 s was exceeded.	Terminate present activation. Then re-activate the pump.
The pump lid symbol (- n -) flashes and the pump cannot be activated or the already activated pump is deactivated.	The pump lid was not closed before activation of the pump.	Close pump lid.
	The pump lid was opened with the pump activated.	Close pump lid.
Display E 1	Motor control faulty.	Change main board, see page 44.
Display E 2	Motor current exceeds the permissible limit. Pump head faulty or damaged.	Check pump head to make sure it is fitted properly. Change pump head if it is faulty, see page 37.
	Motor current exceeds the permissible limit. Gear motor faulty or damaged.	Change gear motor, see page 39.
Display E 3	No measurable current flow. The connection between the gear motor and the main board was interrupted.	Restore connection between gear motor and main board.
	No measurable current flow. Gear motor faulty.	Change gear motor, see page 39.
	No measurable current flow. Current measurement gain has failed.	Change main board, see page 44.
Display E 4	Monitoring circuit of motor control faulty.	Change main board, see page 44.

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Error	Possible cause	Remedy
Display E 5	CRC Check faulty. Due to various influences such as ageing or radiation the memory of the PIC may be altered.	Change main board, see page 44.
Display L 1	A quick activation button was programmed with flow that is too low or too high.	Observe programming rules for quick activation buttons: Flow on button < flow on button Flow on button < flow on button

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CHAPTER 9

Maintenance and servicing

Technical safety check, national regulations, trained persons

ATTENTION! Adjustments, tests, modifications, maintenance and repair work may only be performed by ERBE or persons trained by ERBE. If the work is not performed by trained persons, ERBE accepts no liability and warranty rights become void.

It is recommended that the technical safety check also be performed by ERBE or persons trained by ERBE.

IMPORTANT! The safety check is a preventive measure in which there is examined whether the equipment is safe and ready for operation. In order to perform the tests the relevant specifications and regulations of the particular country must be observed.

Test intervals

IMPORTANT! ERBE recommends performing a technical safety check after every repair, but at least once a year.

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Technical safety check

For simplification the device to be tested is referred to below as the "test specimen".

Important information

WARNING! For safety reasons (personnel protection) the test specimen should generally be operated by a suitable isolating transformer.
An exceptional case is the tests for grounded conductor resistance, ground leakage current, and patient leakage current, in which the test specimen is supplied with current via the safety tester.

ATTENTION! In the event of a fault occurring in the test specimen or individual components during the technical safety check the test steps taken so far no longer apply.
Remedy the defect and repeat the technical safety check from the beginning.

IMPORTANT! It is assumed that the user knows how to operate the test specimen, the test equipment, the measuring equipment, and auxiliary test equipment. The test instructions only apply in conjunction with the relevant test steps.

IMPORTANT! Test equipment, measuring equipment, and auxiliary test equipment (cables, test boxes, etc.) are listed separately at the beginning of each test unit. Where ERBE article numbers are specified, only original ERBE test equipment, measuring equipment, and auxiliary test equipment may be used.

IMPORTANT! The test report for the technical safety check can be requested from ERBE Technical Service Tübingen. For the address see address sheet on last page.

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User manual and visual inspections

- Test specimen and accessories (where enclosed) undamaged externally.
- User manual present.
- All labels on the test specimen (conformity declaration mark, rating plate, and all wording) present and readily legible.

Tests to be conducted in accordance with the national specifications and regulations

Grounded conductor test

- Ground terminal to chassis.
- Ground terminal to potential equalization pin.

Leakage current measurement

- Ground leakage current, normal condition (N.C.).
- Ground leakage current, single-fault condition (S.F.C.).
- Patient leakage current, normal condition (N.C.).
- Patient leakage current, single-fault condition (S.F.C.).

Performance tests

Testing tools

ERBE Art.-No.	Designation
20325-000	Footswitch for EIP 2
20325-001	Tubing set ERBE EIP 2 (100 V, 230 V)

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Test setup

- The test specimen is connected to the power supply via the power cord.

Test procedure

Power switch

1. Check power switch for smooth operation. The power switch must be easy to operate and must neither stick nor scrape.
2. Press power switch. The power switch must snap into the "ON" position and the test specimen must perform a system start.

Control buttons

1. Check all the buttons on the control panel to make sure they are operating properly. Press each button at least twice.

7-segment displays and LEDs

1. Start test specimen in service program mode and select service program S2.
2. **Test 7-segment displays:** All the segments on the three 7-segment displays should be an equally bright green color.
3. **Test LEDs:** The border of the activation button should be backlit in yellow.

Deactivation when opening the pump head / head sensor

1. **Test step 1:** Select 80 % flow on the test specimen. Hold down the activation button and the pump motor will start up. Open the pump head lid, keeping the activation button pressed. The pump motor should stop.
2. **Test step 2:** With the pump lid open, activate the test specimen using the activation button. The pump motor must not start up and on the display a symbol similar to an "n" (= pump lid symbol) should flash.
3. **Test step 3:** Connect up footswitch. Repeat test step 1, now activating the test specimen with the footswitch.
4. **Test step 4:** Repeat test step 2, now activating the test specimen with the footswitch.

Automatic shutdown in the event of continuous activation

1. **Test step 1:** Select 80 % flow on the test specimen and activate the pump motor using the activation button. Activation should stop within a time window of 18 s to 22 s.
2. **Test step 2:** Connect up footswitch. Repeat test step 1, now activating the test specimen with the footswitch. Activation should stop within a time window of 18 s to 22 s.

Check the automatic pressure control

IMPORTANT! For units from software version 1.1.0 onwards, the automatic pressure control can be optionally activated or deactivated (see service program S5). For this test, the automatic pressure control must be activated.

1. Insert tube and fill with irrigation liquid (water).
2. To simulate a blockage, clamp the tube at the distal end.
3. Set pump flow to 100 %.
4. Activate pump motor using activation button (or footswitch) and keep it activated. The test specicmen should reduce flow very audibly.
5. Undo the clamp on the tube. The test specicmen should increase flow very audibly back to set pump flow.
6. Terminate activation.

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CHAPTER 10

Replacing components

Change pump head

WARNING! Unplug the power cord from the outlet before exchanging parts of the unit or cleaning it.

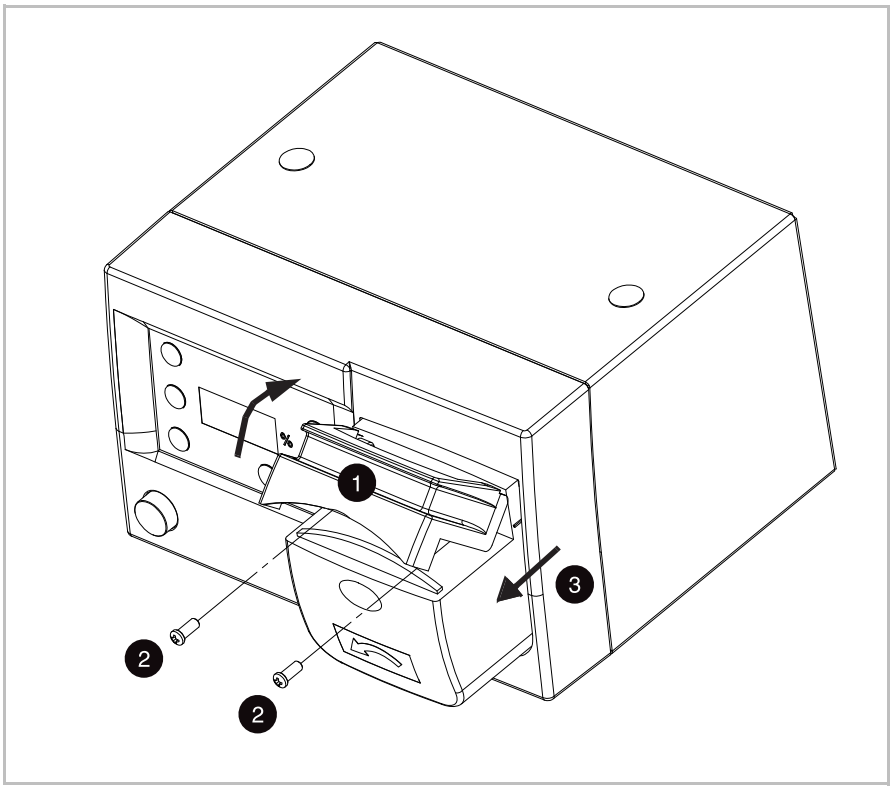
ATTENTION! Adjustments, technical tests, modifications, maintenance and repair work may only be performed by ERBE or persons trained by ERBE. If the work is not performed by trained persons, ERBE accepts no liability and warranty rights become void.

IMPORTANT! Only use original replacement parts.

Tools

- Phillips screwdriver PH 1

Remove pump head



1. Open pump head lid completely.
2. Undo screws (2).
3. Withdraw pump head toward the front.

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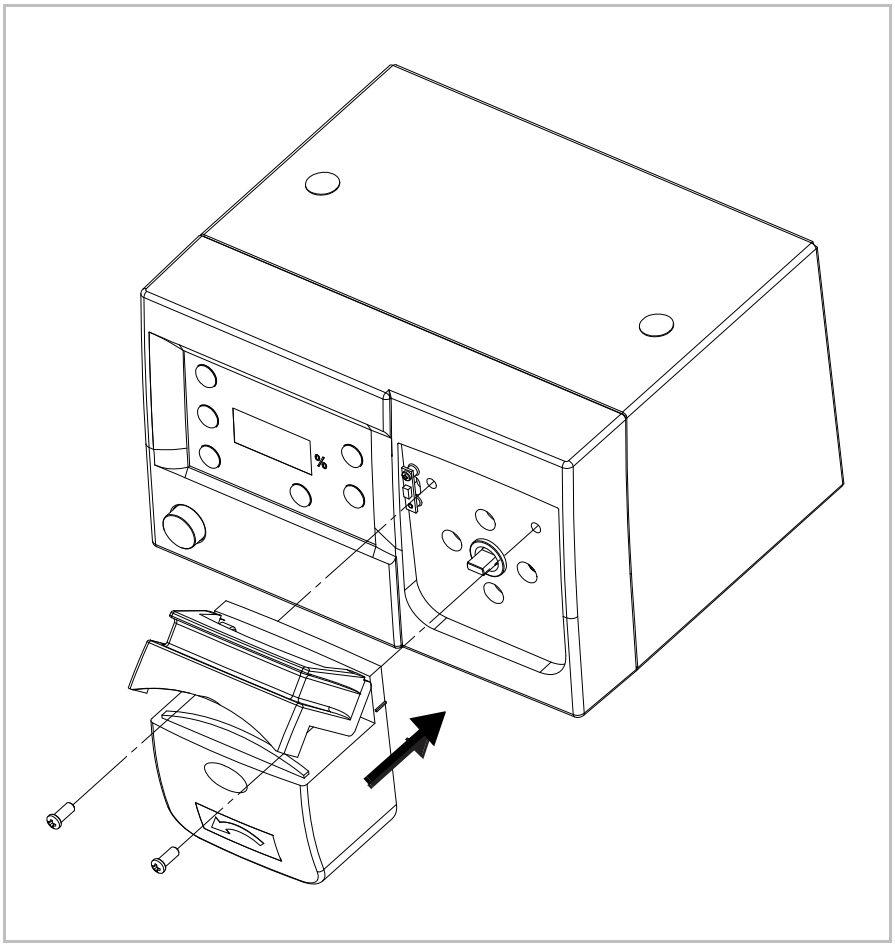
Fit new pump head



4. Fit new pump head in reverse order.

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Change gear motor

WARNING! Unplug the power cord from the outlet before exchanging parts of the unit or cleaning it.

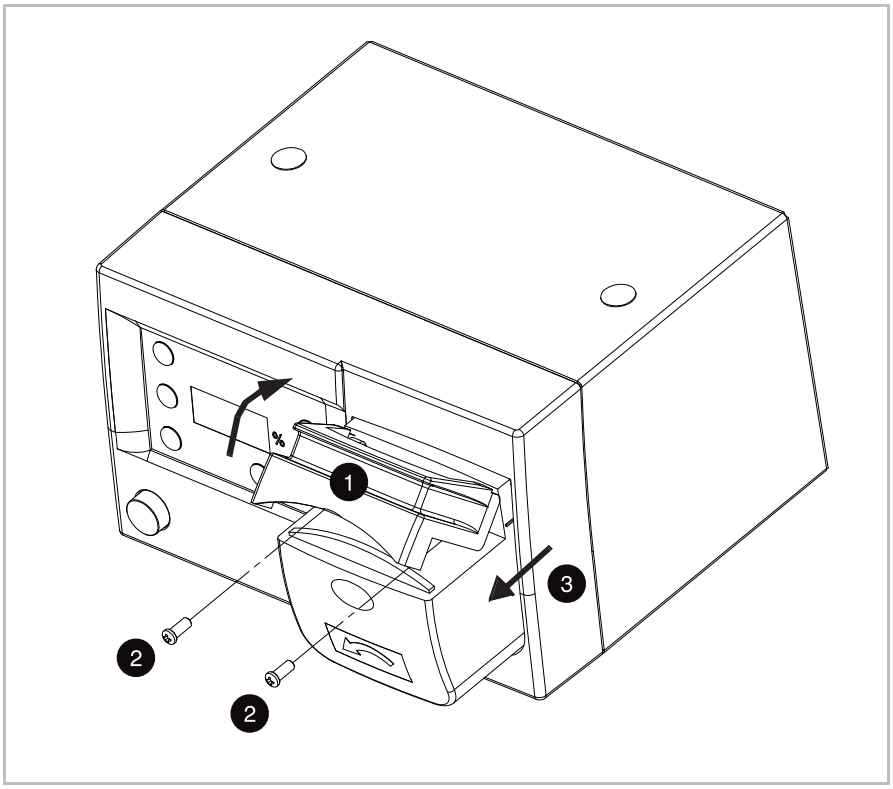
ATTENTION! Adjustments, technical tests, modifications, maintenance and repair work may only be performed by ERBE or persons trained by ERBE. If the work is not performed by trained persons, ERBE accepts no liability and warranty rights become void.

IMPORTANT! Only use original replacement parts.

Tools

- Phillips screwdriver PH 1 (short and long)
- Phillips screwdriver PH 2
- Box wrench size 7

Remove pump head



1. Open pump head lid completely.
2. Undo screws (2).
3. Withdraw pump head toward the front.

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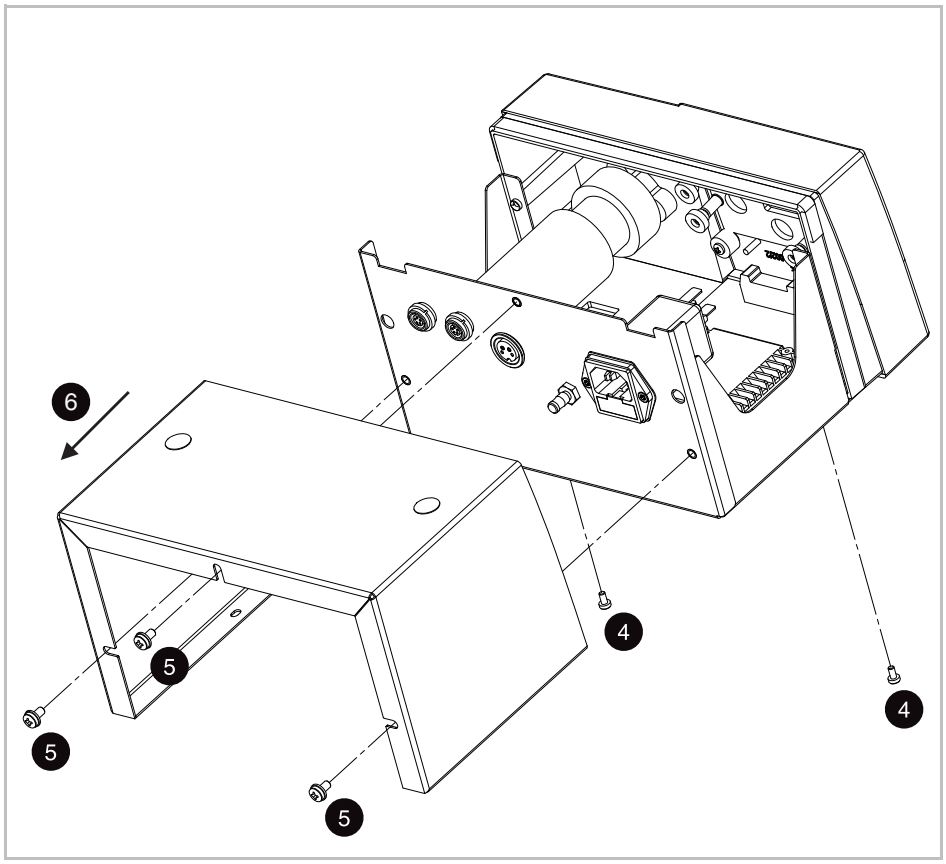
Remove housing cover



4. Undo screws in the sub-base (2).
5. Undo screws in the rear panel (3).
6. Remove housing cover carefully, first upward and then to the rear.

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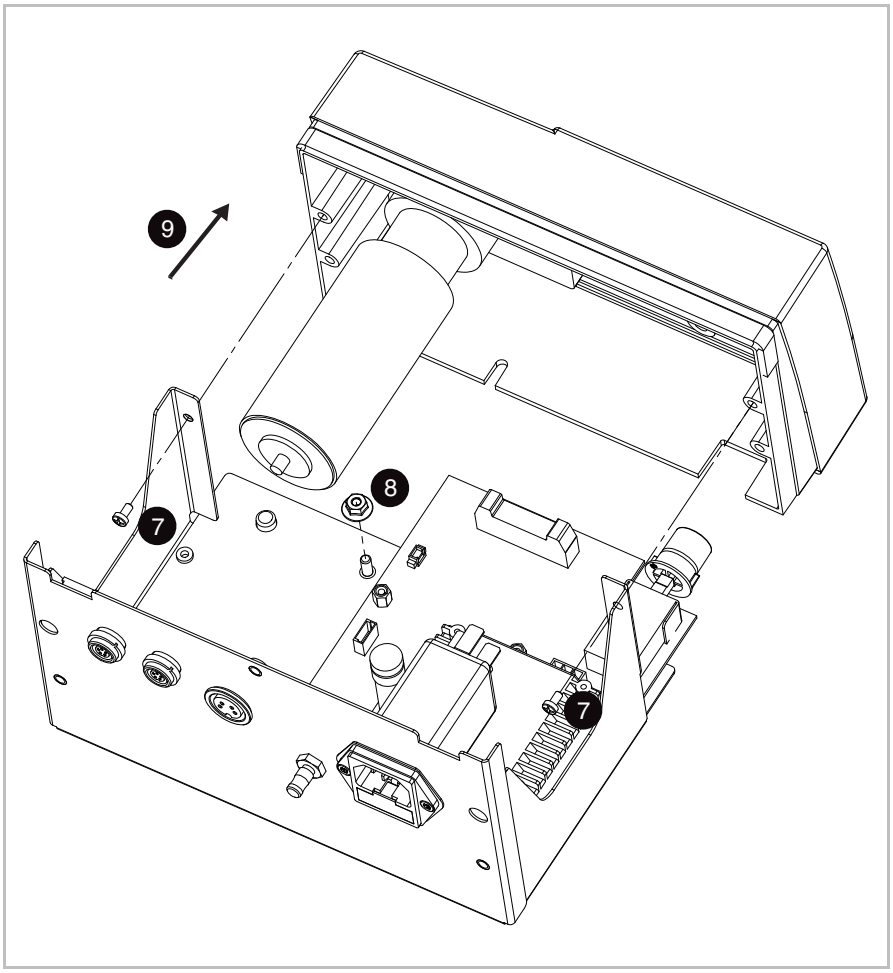
Remove front frame



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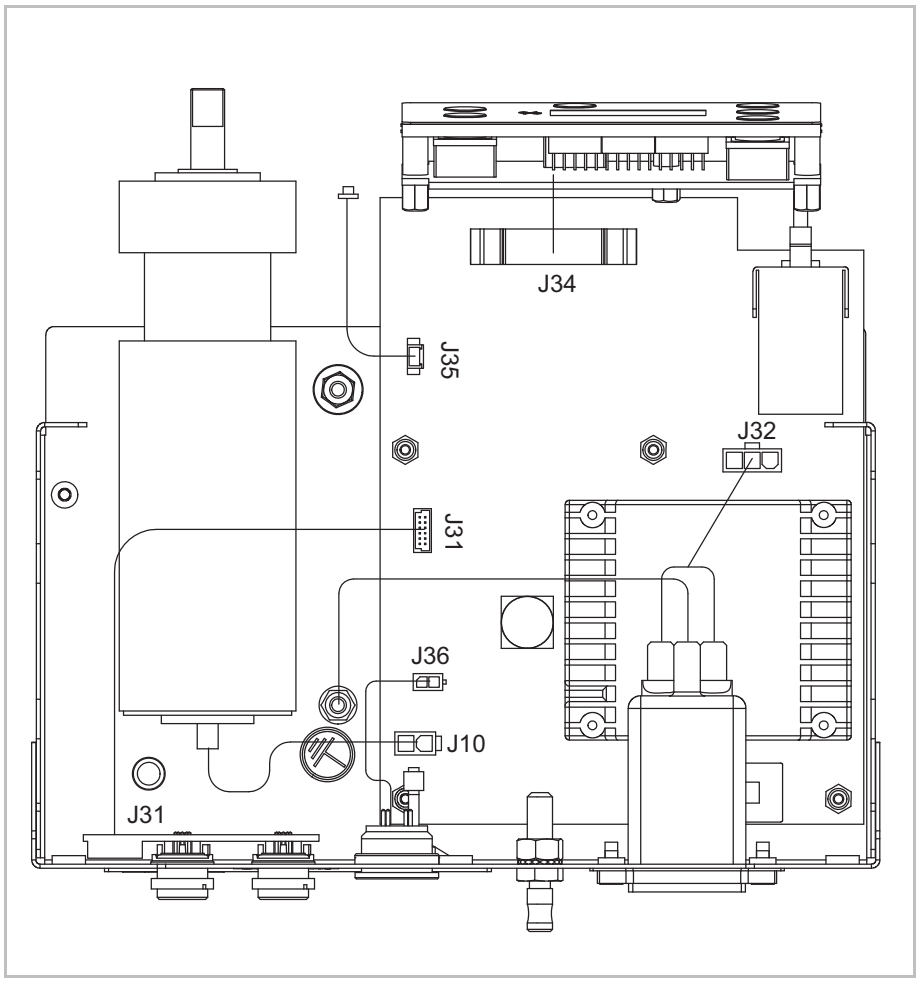
7. Undo screws in the frame (2).
8. Loosen nut (1) in the housing bottom. The nut can be removed completely but does not have to be.
9. Pull away front frame toward the front as permitted by the display connector (not illustrated).



10. Remove connectors J34, J35, and J10 from the main board and remove the front frame completely toward the front.

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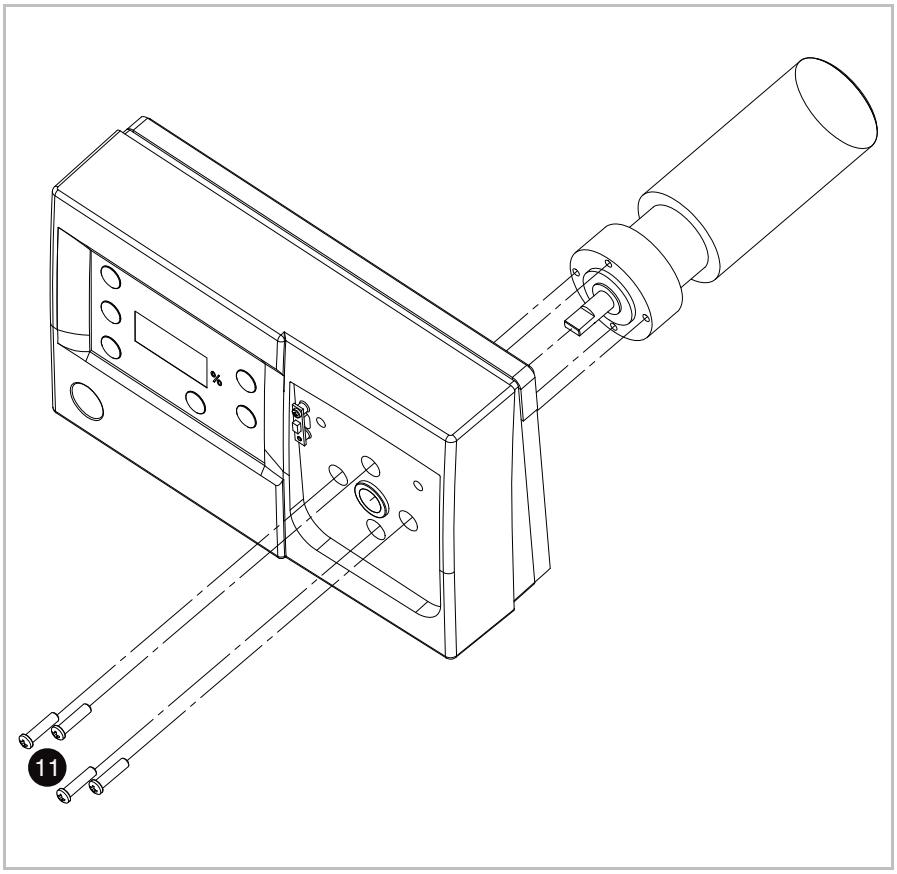
Change gear motor



11. Undo screws on the gear motor (4) and remove the gear motor to the rear.
12. Fit a new gear motor in reverse order.
13. Fit front frame in reverse order.

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ATTENTION! **Check line voltage setting**

The EIP 2 can be operated on a line voltage of 230 V, 120 V, or 100 V. Therefore, every time the unit is opened always check afterwards whether the correct line voltage ±10 % is set on the line voltage selector switch on the main board.

14. Close housing cover.

Change main board

WARNING! Unplug the power cord from the outlet before exchanging parts of the unit or cleaning it.

ATTENTION! Adjustments, technical tests, modifications, maintenance and repair work may only be performed by ERBE or persons trained by ERBE. If the work is not performed by trained persons, ERBE accepts no liability and warranty rights become void.

IMPORTANT! Only use original replacement parts.

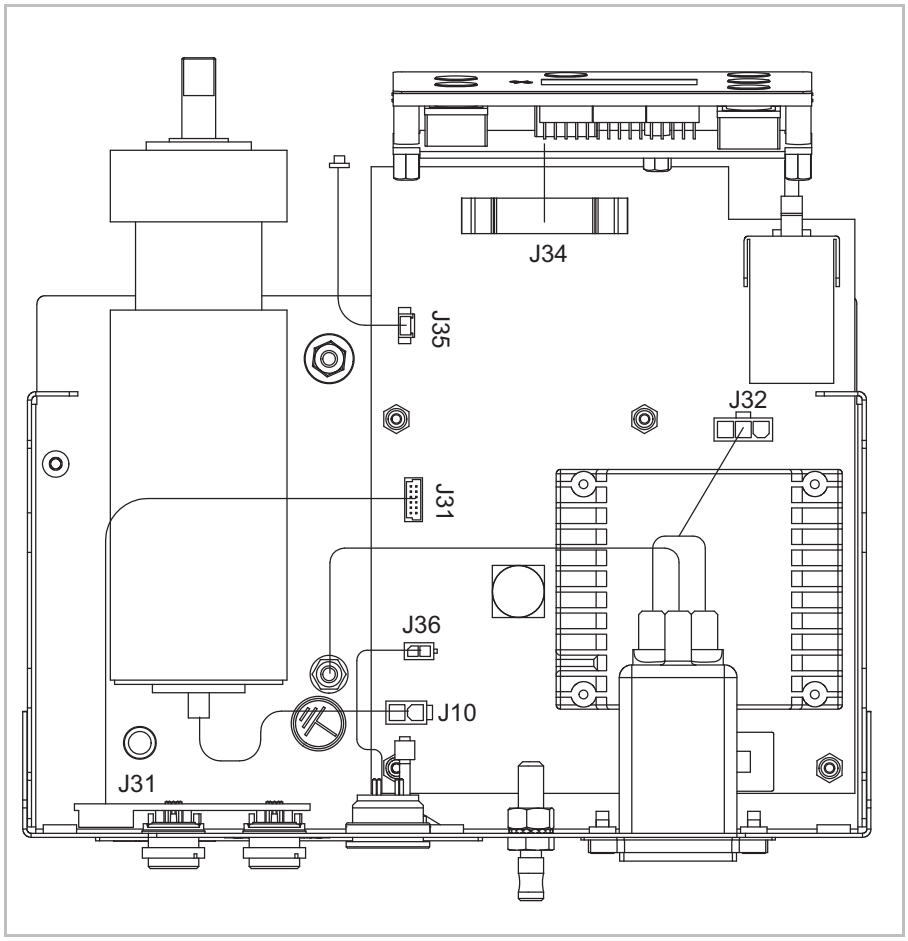
Tools

- Phillips screwdriver PH 1 (short and long)
- Phillips screwdriver PH 2
- Box wrench size 7

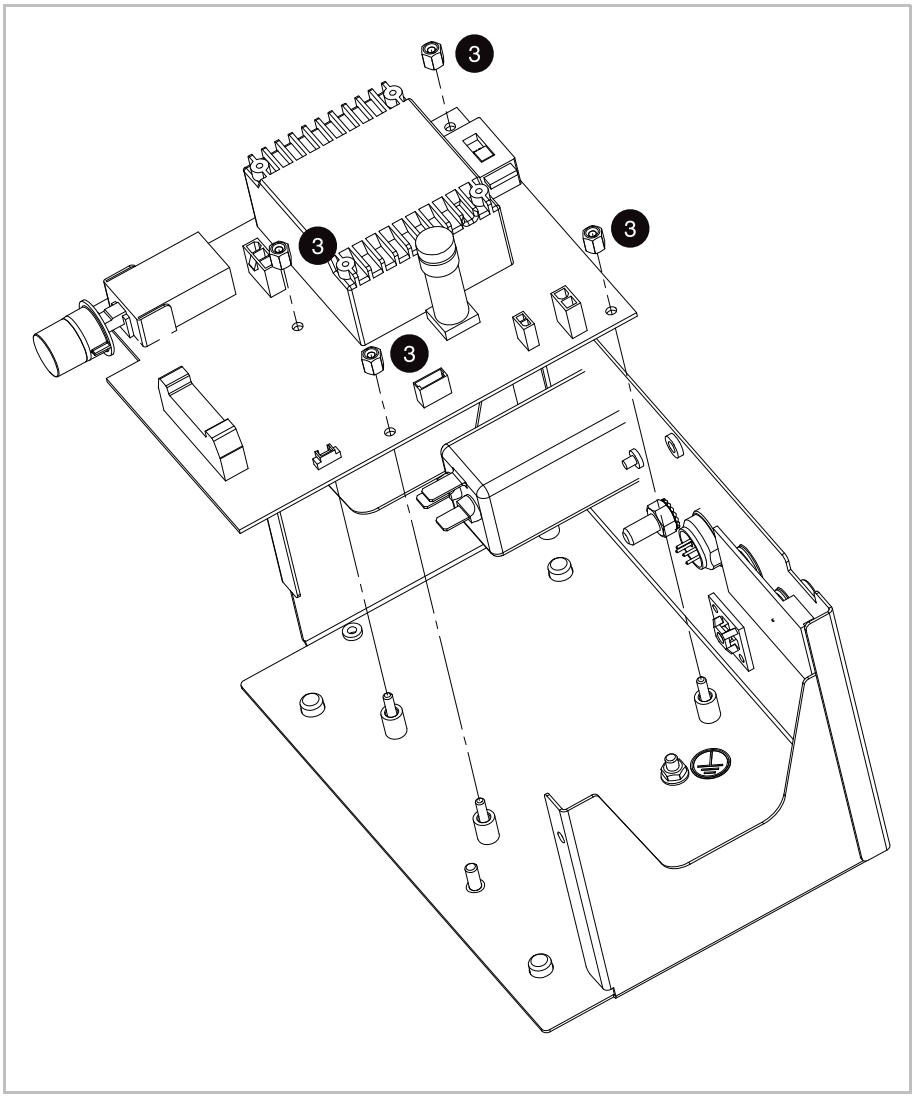
Remove housing cover see page 40.

Remove front frame see page 41.

Change main board



1. Remove connectors J32 and J36 from main board.
2. Only units with ECB socket (ECB = ERBE Communication Bus) also remove connector J31 from main board.



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3. Undo nuts (4) and withdraw main board carefully.
4. Fit new main board in reverse order.
5. Fit front frame in reverse order.

ATTENTION! **Check line voltage setting**

The EIP 2 can be operated on a line voltage of 230 V, 120 V, or 100 V. Therefore, every time the unit is opened always check afterwards whether the correct line voltage ±10 % is set on the line voltage selector switch on the main board.

6. Close housing cover.

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CHAPTER 11

Spare parts

Abbreviations

ECB = ERBE Communication Bus

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EIP 2 without ECB

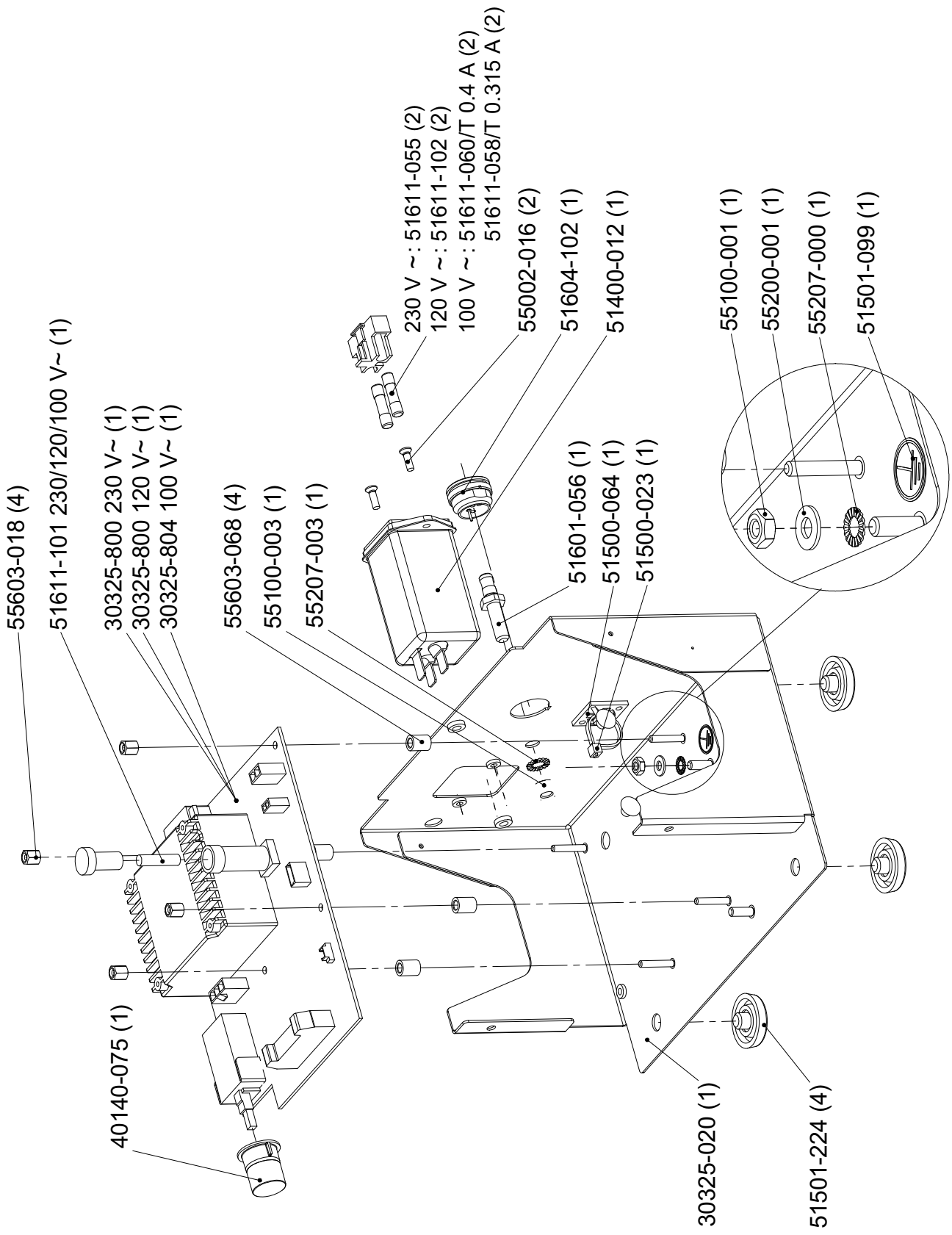

Fig. 11-1

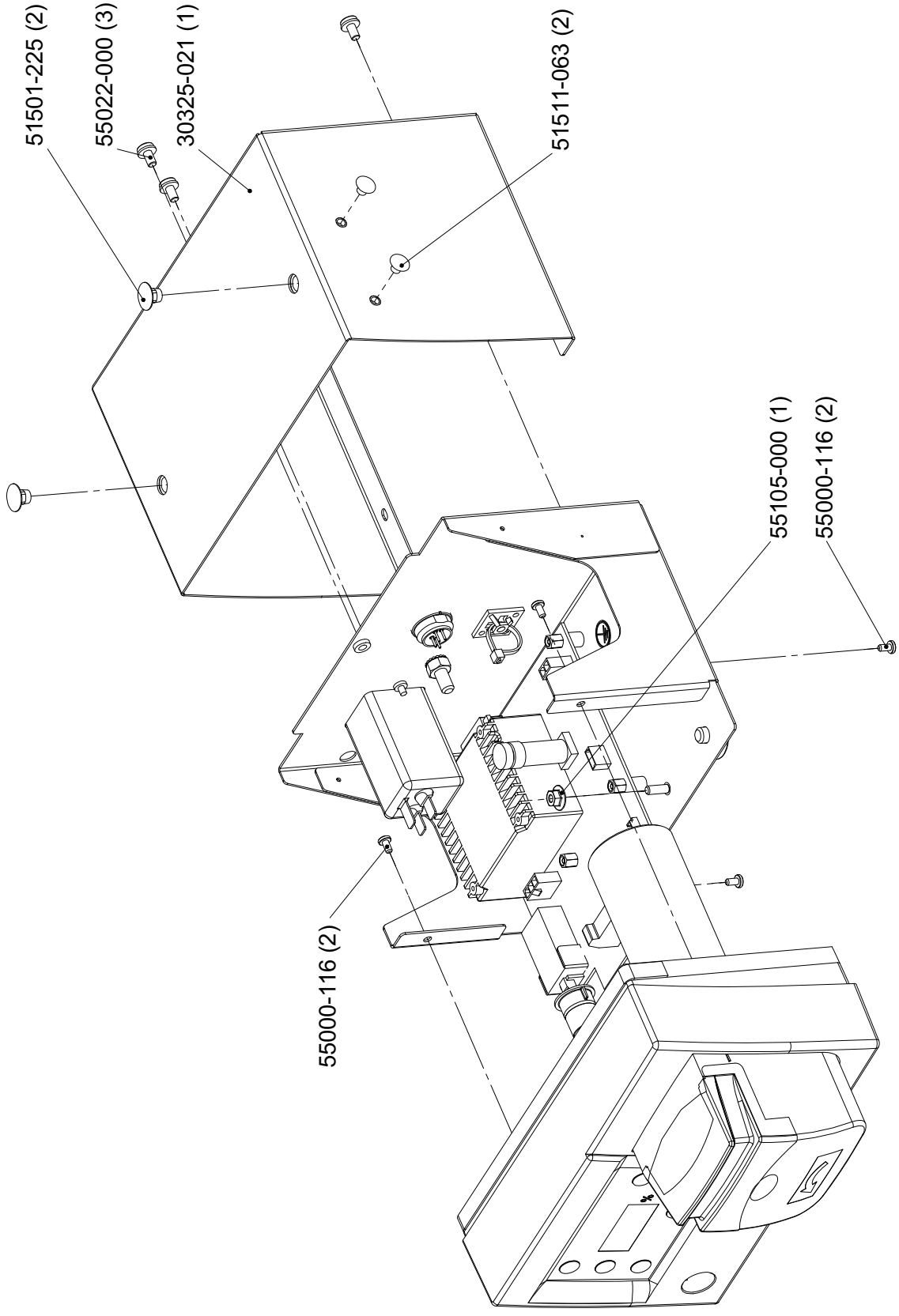

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Fig. 11-2

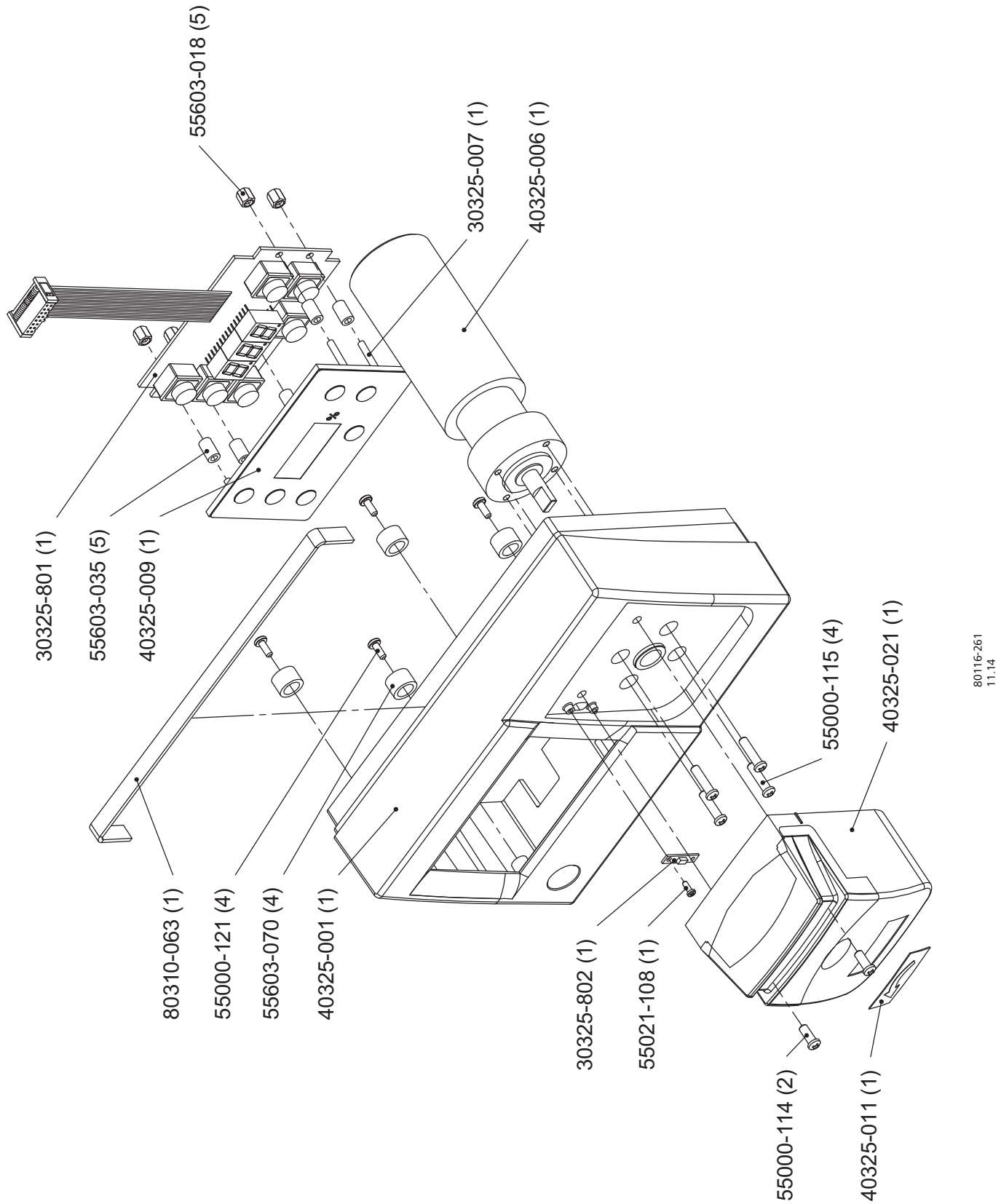
55603-018 (5)
30325-007 (1)
40325-006 (1)
30325-801 (1)
55603-035 (5)
40325-009 (1)
80310-063 (1)
55000-121 (4)
55603-070 (4)
40325-001 (1)
55000-115 (4)
40325-021 (1)
30325-802 (1)
55021-108 (1)
55000-114 (2)
40325-011 (1)
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Fig. 11-3

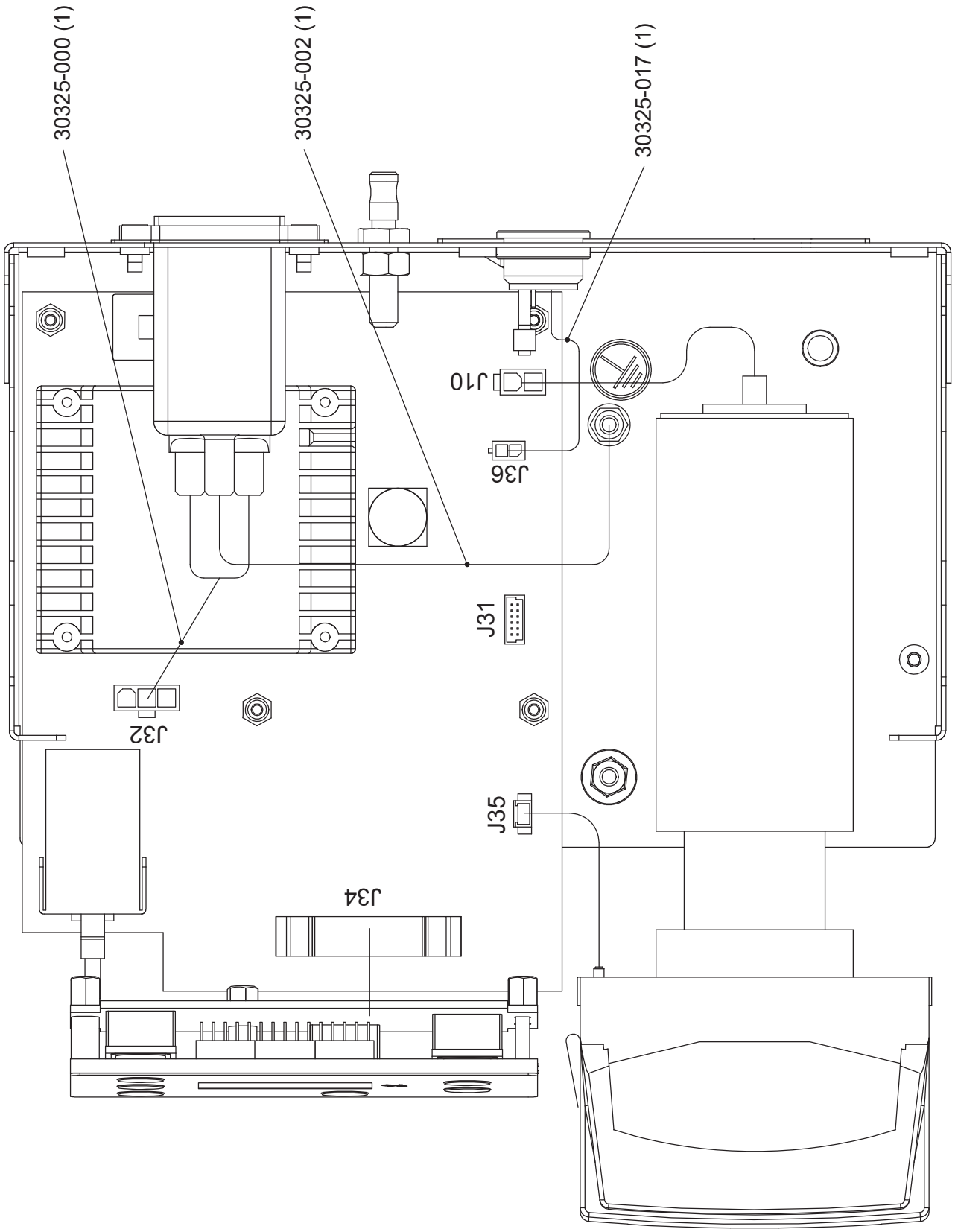

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Fig. 11-4

EIP 2 with ECB

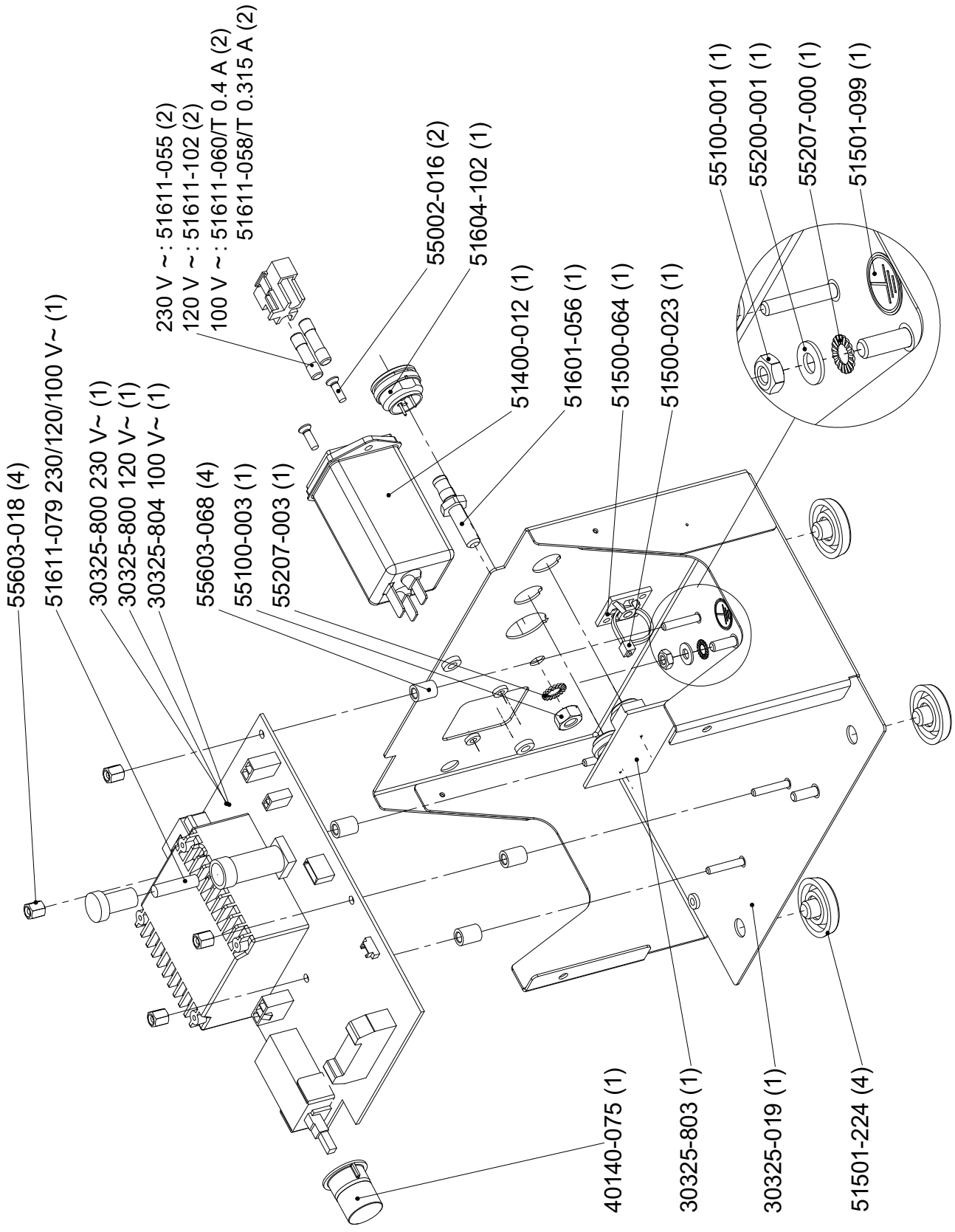

Fig. 11-5

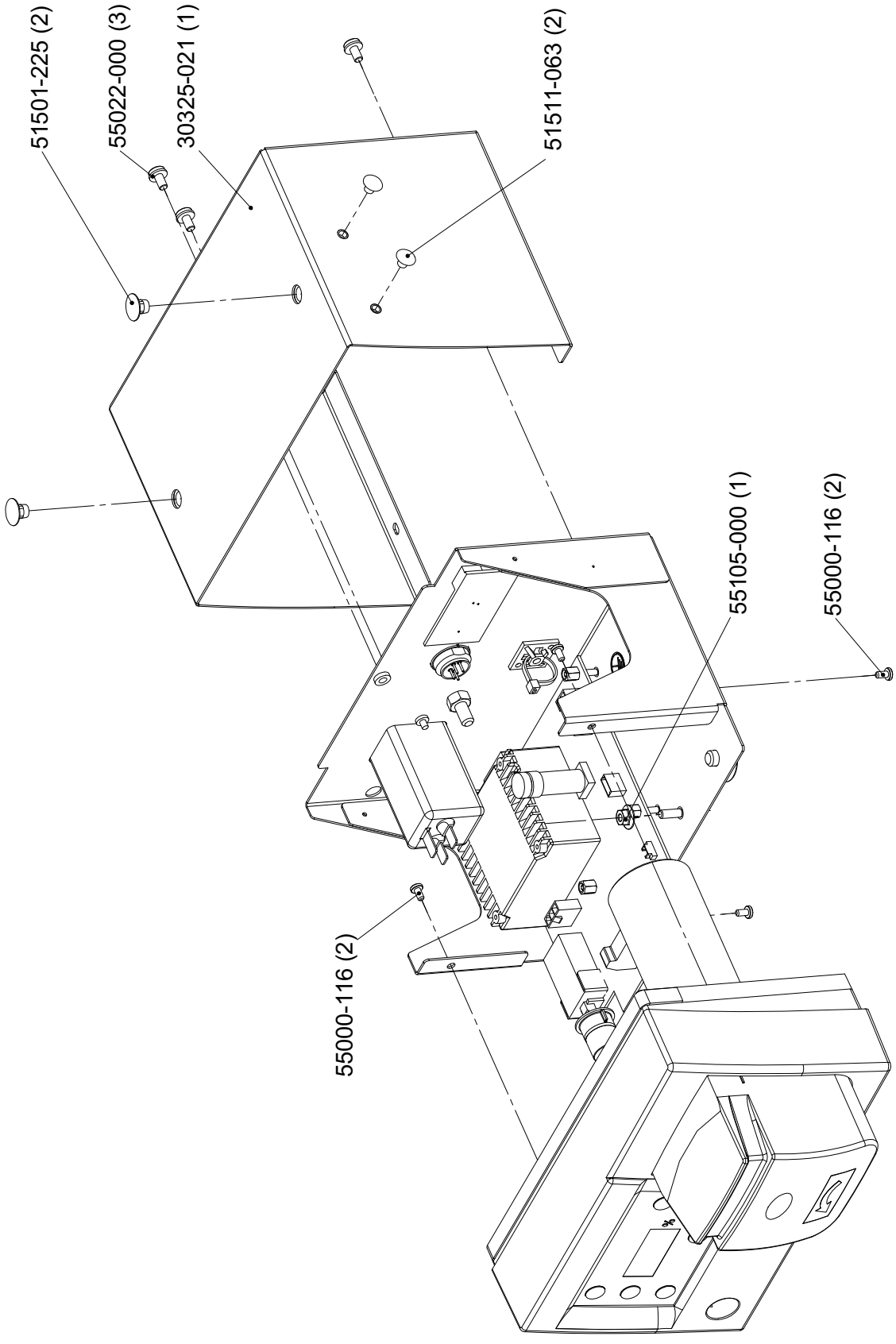

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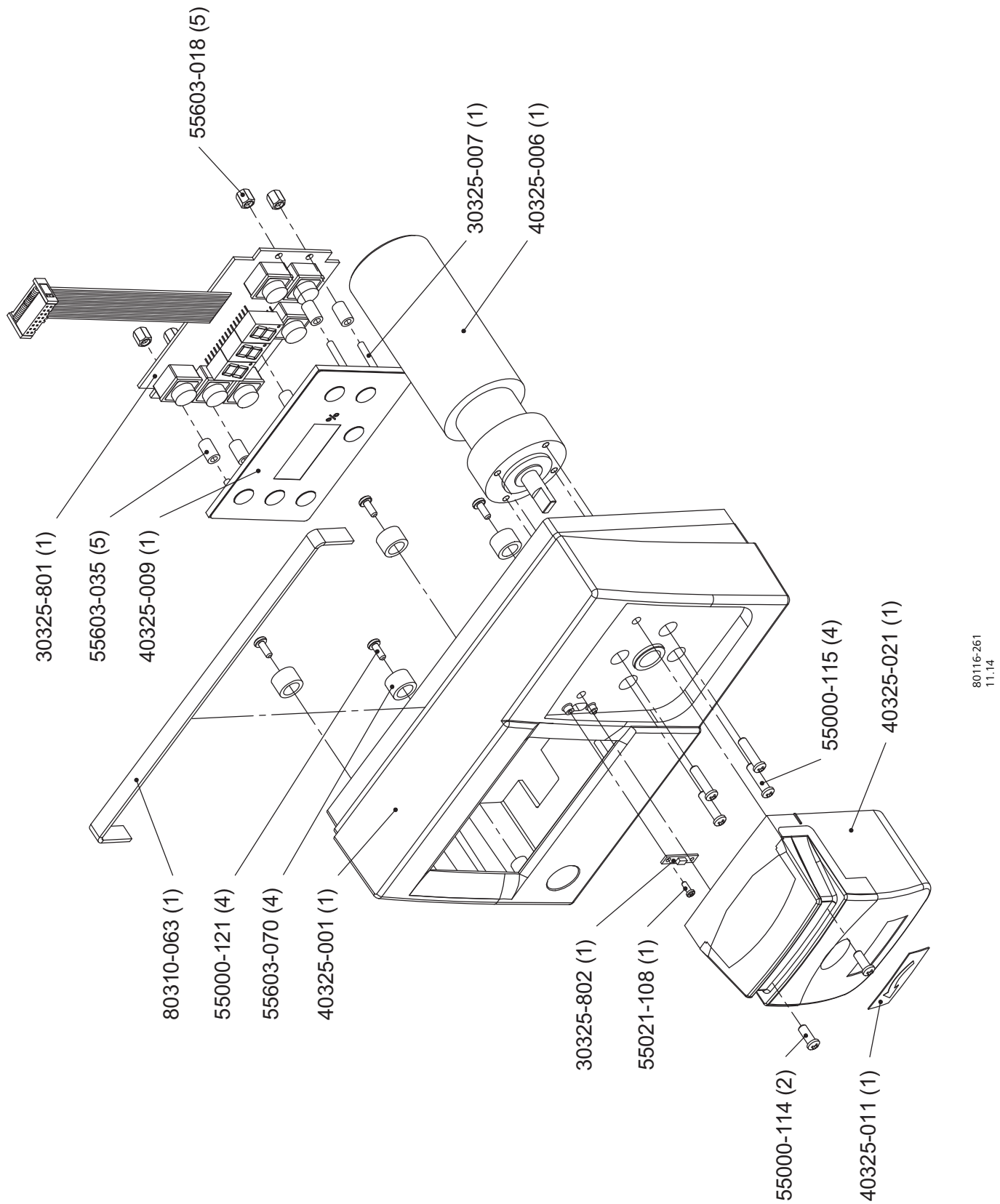
Fig. 11-6


55603-018 (5)
30325-007 (1)
40325-006 (1)
30325-801 (1)
55603-035 (5)
40325-009 (1)
80310-063 (1)
55000-121 (4)
55603-070 (4)
40325-001 (1)
55000-115 (4)
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55021-108 (1)
55000-114 (2)
40325-011 (1)
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Fig. 11-7

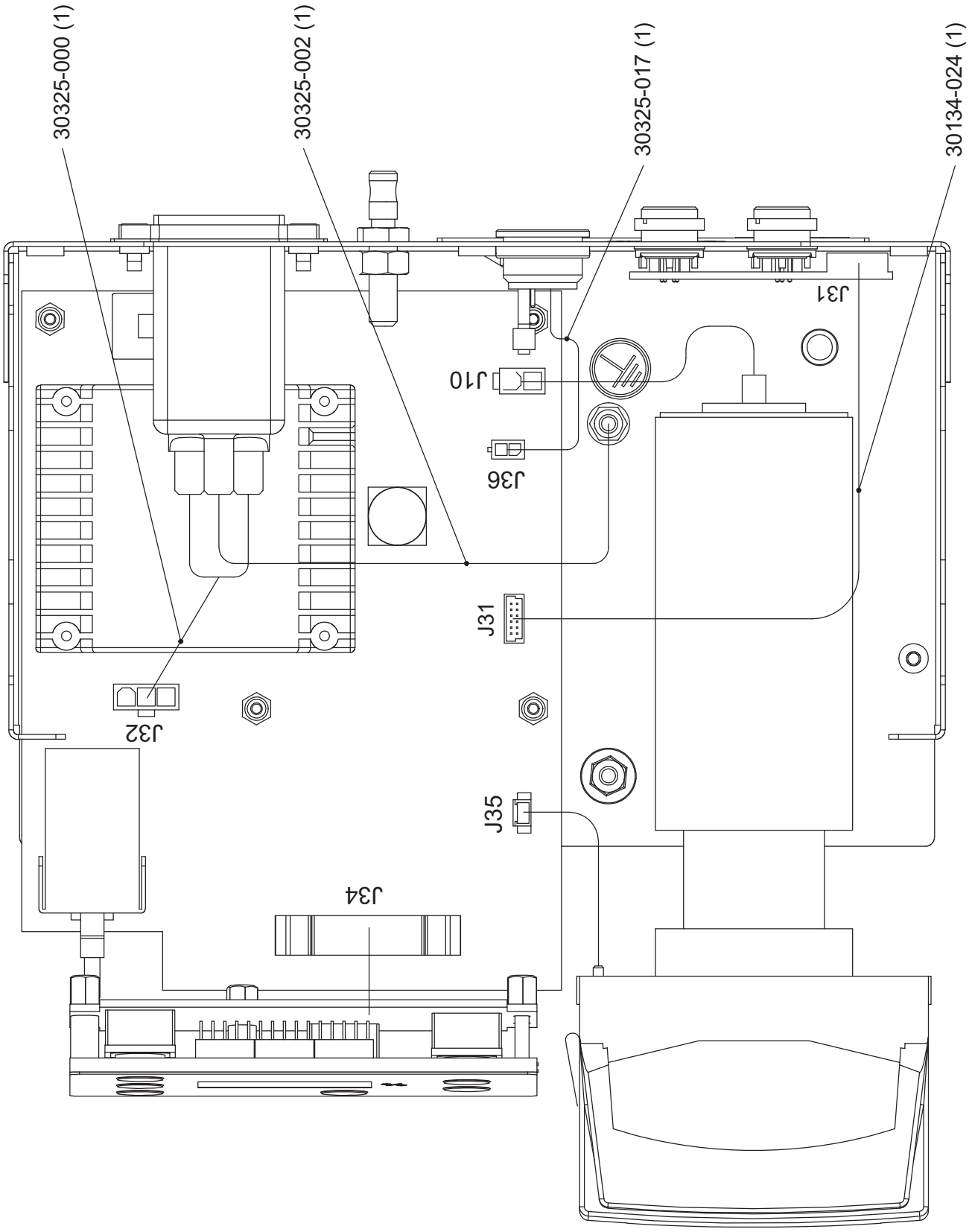

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Fig. 11-8

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